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Persisting psychotic-like experiences are associated with both externalising and internalising psychopathology in a longitudinal general population child cohort

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ABSTRACT

Background: Persisting psychotic-like experiences (PLEs) are associated with an increased risk of internalising symptoms in adolescence. Whether this association holds similarly for externalising symptoms, and from mid-childhood, is unclear. This prospective study investigated the extent to which PLE persistence was associated with internalising and externalising psychopathology in a community sample of children aged 9–11 years at study commencement.
Methods: 8099 children (mean age 10.4 years) completed questionnaires assessing PLEs, externalising and internalising symptoms. A subsample of 547 children completed reassessment, on average, two years later.
Results: Two-thirds (66%) of children reported PLEs at baseline. Approximately two years later, PLEs persisted in 39% of those children. After adjustment for previous psychopathology and other potential confounds, children with persisting PLEs were at higher risk for internalising (odds ratio [OR] = 1.94; 95% confidence interval [CI] 1.13–3.34) and externalising (OR = 1.97; 95% CI 1.19–3.26) psychopathology than children whose PLEs remitted; and, than children who never presented PLEs.
Conclusions: Persistent PLEs from mid-childhood are associated with later internalising and externalising psychopathology in the general population, whereas transitory PLEs may be part of a spectrum of normative childhood development. Interventions that target persistent PLEs may contribute to a reduction in common childhood psychopathology.

1. Introduction

Subclinical psychotic symptoms or psychotic-like experiences (PLEs) in childhood and adolescence are associated with concurrent emotional and behavioural difficulties (Laurens et al., 2007, 2011, 2012; Nishida et al., 2008; Scott et al., 2009; Armando et al., 2010; Bartels-Velthuis et al., 2010; Polanczyk et al., 2010; Barragan et al., 2011; Kelleher et al., 2012b). PLEs that persist into adulthood increase risk for social dysfunction (Rossler et al., 2007), affective disturbance (van Rossum et al., 2011), substance misuse (Dhossche et al., 2002), and psychotic disorder (Dominguez et al., 2011). As PLEs may herald later psychosis, the DSM-V task force on schizophrenia and psychotic disorders recently debated the inclusion of an 'attenuated psychosis syndrome' among adolescents and young adults as a diagnostic category (Yung et al., 2012). However, PLEs are common in child and adolescent populations (Kelleher et al., 2012a), and typically constitute transitory phenomena (Yung et al., 2009; Dominguez et al., 2011). It remains unclear which factors distinguish benign PLEs from pathological (Nelson and Yung, 2009).

PLEs prior to adolescence may constitute part of a spectrum of normative development (Laurens et al., 2012). Longitudinal studies following adolescents into adulthood distinguish short-lived or transitory PLEs that may be relatively benign from persistent PLEs that impose a greater likelihood of concurrent, and later, psychiatric morbidity and social impairment (Cougnard et al., 2007; Woods et al., 2009; Dominguez et al., 2011). Recent longitudinal work employing adolescent samples indicates that persistent PLE trajectories, compared with non-persistent trajectories, are associated with the highest levels of internalising psychopathology (i.e., symptoms of anxiety, depression, or social withdrawal) at follow-up (Mackie et al., 2010; De Loore et al., 2011).

Before robust conclusions about the impact of PLE persistence on later psychopathology can be drawn, limitations within the current paediatric literature need to be addressed. Firstly, most studies have measured PLEs only from early–mid adolescence, despite growing evidence that children as young as eight years old can give a reliable and valid account of these experiences (Laurens et al., 2007, 2012; Bartels-Velthuis et al., 2010).

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Two longitudinal studies following PLE expression from mid-childhood (8–11 years) both indicated the predictive validity of psychotic phenomena for adolescent psychopathology. However, these studies were limited by instruments that (a) did not specifically target PLEs but assessed a broader range of 'thought problems' (Wigman et al., 2011b) or (b) examined auditory hallucinatory phenomena only (Bartels-Velthuis et al., 2011). Secondly, few studies have examined whether PLEs act independently of concurrent internalising or externalising (i.e., hyperactive, aggressive, antisocial, or oppositional behaviours) psychopathology in the prediction of later psychopathology. Two studies which adjusted for past psychopathology provide contrasting accounts of the predictive validity of PLE persistence. Wigman et al. (2011a) examined adolescent and adult patients over two years and found that PLE persistence did not predict changes in internalising problems, whilst De Loore et al. (2011) reported that adolescents with persisting hallucination symptoms were twelve times more likely to report internalising problems at two-year follow-up. Lastly, longitudinal population-based studies have focused typically on the relationship between PLEs and internalising problems only. Externalising problems also warrant examination, as there is heterotypic (cross-disorder) continuity between externalising and internalising disorders (Costello et al., 2003), and cross-sectional studies indicate that PLEs are associated with externalising problems (Laurens et al., 2007, 2012; Kinoshita et al., 2011; Kelleher et al., 2012b).

Using a prospective longitudinal study that assessed PLEs at two time-points in a community sample of school children aged 9–11 years at baseline, we aimed to address these limitations. We examined whether persisting PLEs predicted internalising and externalising problem outcomes at follow-up, after adjusting for the effect of past internalising and externalising psychopathology. We compared internalising and externalising problem outcomes between children with persisting PLEs relative to children who reported no PLEs at either time-point, as well as relative to children with transitory (remitting) PLEs. We hypothesised that children with persisting PLEs would have a greater likelihood of internalising and externalising problem outcomes relative to children who never experienced PLEs, and also relative to children with remitting PLEs. We further anticipated that children with remitting PLEs would be no more likely to later report externalising and internalising psychopathology than their peers without PLEs, thus implying that PLEs which do not persist beyond childhood may be part of a spectrum of normative development that confer little risk for later psychopathology in adolescence.

2. Method

2.1. Study design

This prospective longitudinal study collected data at two assessments. Baseline (BL) data were collected between 2005 and 2010 in 73 primary schools within Greater London, the procedure for which has been described previously in detail (Laurens et al., 2007, 2008, 2012). In brief, 8099 children (50% male) aged 9–11 years (mean 10.4 years, sd 0.8 years) completed questionnaires in class, with corresponding questionnaires completed by the child's primary caregiver at home and returned via reply-paid mail. Caregivers indicated consent to further contact, with 850 (10%) responding affirmatively. The follow-up (FU) assessment was conducted between 2007 and 2011 with the subsample of 676 caregiver–child dyads whose contact details remained valid. FU participants were invited to complete questionnaires individually either at home or at the research institute, and received a £5 book voucher for participation. Seventy-five families (11% of eligible dyads) who were sent study packs did not return their questionnaires; a further 54 caregivers (8%) withdrew consent for follow-up assessment. In total, 547 caregiver–child dyads (81% of the viable sample) provided follow-up data.

Ethical approval for the respective research phases (BL, FU) were provided by the Joint South London and Maudsley and the Institute of Psychiatry NHS Research Ethics Committee and the King's College London Research Ethics Committee.

2.2. Measures

2.2.1. Internalising and externalising psychopathology

These domains were assessed via the parent- and self-report versions of the 25-item Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997, 2001). Sound psychometric properties for parent-report SDQ (ages 4–16 years) and self-report SDQ (ages 11–16 years) are well established in community and clinical samples (Goodman et al., 2001, 2010); and self-report versions have been utilised with children as young as 8 years (Muris et al. 2004; Di Riso et al, 2010) with preserved reliability and validity, yielding a consistent factor structure (van Roy et al. 2008), comparable internal consistency and test–retest reliability (Muris et al. 2003), and demonstrated criterion validity in discriminating between children with and without psychiatric problems (Muris et al., 2004).

The SDQ includes four psychopathology subscales that assess Conduct Problems, Hyperactivity–Inattention, Emotional Symptoms, and Peer Relationship Problems; a fifth subscale (Prosocial Behaviour) assesses personal strengths. An established algorithm delineating 'abnormal' scores was applied for each subscale, which identifies those children with a high probability of meeting clinical thresholds for mental health diagnoses (Goodman et al., 2003). In community samples, the SDQ psychopathology scale items load most parsimoniously on internalising and externalising psychopathology domains (Goodman et al., 2010; Laurens et al., 2012). Parent- and child-reports provide valid, though often contrasting, perspectives on psychopathology among children aged between 8 and 16 years (Goodman, 2001; Muris et al., 2004; De Los Reyes and Kazdin, 2005). Hence, for this study, the presence of internalising psychopathology was defined as an abnormal rating (caregiver- or child-reported) on either the Emotional Symptoms or Peer Relationship Problems subscales. Externalising psychopathology was defined as the presence of an abnormal rating (caregiver- or child-reported) on either the Conduct Problems or Hyperactivity–Inattention subscales.

2.2.2. Psychotic-like experiences

PLEs were assessed via nine child-report items (Laurens et al., 2007, 2012) including five questions adapted from the Diagnostic Interview Schedule for Children (Costello et al., 1982) covering auditory hallucinations, ideas of mind being read, ideas of reference, paranoid ideas, and ideas of somatic changes, and a further four items assessing visual hallucinations, passivity phenomena, telepathic experiences, and grandiosity. Each item was rated on a three-point scale: '0 — not true'; '1 — somewhat true'; or '2 — certainly true'. We have previously demonstrated good internal consistency among the nine items for children aged 9–11 years (Laurens et al., 2007), with all items loading on a single latent construct that is distinguished from internalising and externalising psychopathology constructs (Laurens et al., 2012). A comparable, seven-item instrument used to screen paediatric community samples for PLEs has demonstrated good criterion validity between a 'certainly-true' rating on any PLE item and clinician-rated psychotic symptoms on diagnostic interview (Kelleher et al., 2011).

PLE presence was defined as a 'certainly-true' rating on at least one of the nine PLE items. Four PLE trajectories were determined using data obtained from BL and FU: (i) No PLEs — children who reported no certainly-true PLE at either BL or FU; (ii) Remitting PLEs — children who reported at least one certainly-true PLE at BL, but none at FU; (iii) Incident PLEs — children who reported no certainly-true PLE at BL, but reported at least one at FU; and (iv) Persisting PLEs — children who reported at least one certainly-true PLE at both BL and FU.

2.3. Statistical analysis

To determine whether children recruited into the longitudinal cohort (n = 547) differed on baseline measures from children who completed BL self-reported assessments only (n = 7552) independent samples t-tests were used to detect sample differences in age. Chi-squared tests were used for sex, presence of internalising psychopathology, presence of externalising psychopathology, and presence of PLEs. A weighting procedure was applied to adjust the longitudinal cohort so that it represented the prevalence on each measure in the entire community sample of 8099 children completing questionnaires aged 9–11 years.

Analyses were undertaken to identify factors that might confound the association between PLE trajectories and internalising and externalising psychopathology at FU. Thus, the four PLE trajectories were compared on sex, age at BL, age at FU, duration lapsing between BL and FU assessments, presence of BL internalising psychopathology, and presence of BL externalising psychopathology. Any variable on which PLE trajectories differed significantly was retained as a covariate in adjusted regression models.

Logistic regression analyses were conducted to compare rates of FU internalising and FU externalising psychopathology outcomes for children within the persisting PLEs, remitting PLEs, and No PLEs trajectories (too few children reported incident PLEs for viable statistical comparison). Models were subsequently adjusted for potential confounds. Analyses were conducted using SPSS for Windows, version 17.0.

3. Results

3.1. Sample characteristics

Among 8099 children (50% male) who completed the school-based questionnaire assessment at BL aged 9–11 years, two-thirds (66%) self-reported at least one certainly-true PLE rating, 15% self-reported internalising psychopathology, and 25% self-reported externalising psychopathology. Males were significantly underrepresented in the longitudinal cohort (46%) relative to the baseline community sample, as was presence of BL externalising psychopathology (21%), and children were a month younger on average (10.3 months, sd 0.8). Thus, a sample weighting procedure was employed in the analyses of longitudinal cohort data to represent the entire community sample assessed at baseline.

FU assessments were completed, on average, 23 months after BL assessments. Whilst a small number of children experienced particularly long (6 years) or short (3 months) follow-up durations, 95% of the sample had follow-up durations of between 5 and 59 months. Mean age at FU was 12.2 years (sd = 1.6, range 9.5–17.1). At follow-up, the prevalence of any certainly-true PLE rating was 30%, internalising psychopathology was 28%, and externalising psychopathology was 30%. Both child- and caregiver-reports provided positive ratings of psychopathology in the longitudinal sample, with caregivers identifying 76% and 89% of the positive internalising endorsements at BL and FU respectively, and 54% and 64% of the positive externalising endorsements at BL and FU respectively, whilst children identified 44% and 33% of the positive internalising endorsements at BL and FU respectively, and 73% and 63% of the positive externalising endorsements at BL and FU respectively (between 18 and 28% of these positive endorsements were identified by *both* the child and caregiver).

The prevalence of PLE trajectories over two years were: persisting 25.8%, remitting 40.1%, incident 4.6%, and no PLEs 29.5%. Almost two-thirds of children (61%) who reported at least one certainly-true PLE rating at BL no longer did so at FU. The small number of children in the incident PLE group (n = 26) precluded further statistical analyses of this trajectory. Sex, BL internalising and BL externalising psychopathology, FU age, and duration lapsing between BL and FU assessments were significantly associated with PLE trajectory group, and were thus retained as covariates in later logistic regression models.

3.2. PLE trajectory outcomes

3.2.1. Internalising psychopathology

Logistic regression analyses that compared FU internalising psychopathology outcomes between the persisting PLE, remitting PLE, and no PLE trajectories are summarised in Table 1. Children with persisting PLEs were over three times more likely than children in the no PLE group to have internalising psychopathology at FU in the unadjusted model. This effect remained significant after adjusting for all confounds (sex, FU age, duration of follow-up, and BL internalising and BL externalising psychopathology). Compared to children with remitting PLEs, children with persisting PLEs were almost twice as likely to present internalising psychopathology at FU. Again, these effects remained significant, and of similar (slightly increased) magnitude, after adjustment for confounding factors. Although children with remitting PLEs were somewhat more likely than children without PLEs to present FU internalising psychopathology in the unadjusted analysis (OR = 1.69, p = 0.04), this association was not statistically significant after controlling for BL externalising and BL internalising psychopathology (OR = 1.27, p = 0.4).

3.2.2. Externalising psychopathology

Table 2 presents the results of logistic regression analyses comparing FU externalising psychopathology outcomes between the persisting PLE, remitting PLE, and no PLE trajectories. Compared to children in the no PLE group, children with persisting PLEs were more than twice as likely to present externalising psychopathology at FU. This effect remained significant after adjusting the model for sex, FU age, duration of follow-up and BL internalising psychopathology. Adjusting the model further for BL externalising psychopathology reduced the relationship to marginal significance (p = 0.07). Children with persisting PLEs, compared to their peers with remitting PLEs, were twice as likely to present externalising psychopathology at FU, even after full adjustment for potential confounding factors. Children with remitting PLEs were no more likely than those in the no PLE group to present with externalising psychopathology at FU in the unadjusted or adjusted analyses.

4. Discussion

4.1. Prevalence of PLEs

Within our large community sample of children aged 9–11 years (mean age 10.4 years), two-thirds reported at least one certain PLE. The sample was drawn predominantly from deprived inner-city London (Laurens et al., 2007, 2008, 2012) and exceeds the prevalence of PLEs described in other pre-adolescent samples (range 6–17%, Poulton et al., 2000; Polanczyk et al., 2010; Wigman et al., 2011b). This elevated prevalence may relate to the demographics of this sample: the residing adult community has an elevated incidence of schizophrenia (Kirkbride et al., 2006) in addition to a self-reported PLE prevalence of 20% (Morgan et al., 2009). The study methodology may also have affected PLE prevalence: self-report questionnaires commonly yield higher PLE prevalences than face-to-face interviews (van Os et al., 2009).

At follow-up, on average two years later, the PLE prevalence was 30% and within the prevalence range (15–38%) reported by several large urban adolescent cohort samples using self-report questionnaires (Yung et al., 2009; De Loore et al., 2011; Dominguez et al., 2011; Kelleher et al., 2011). Only 39% of children who originally reported PLEs continued to do so two years later. This is comparable with PLE persistence rates of 36–40% observed over similar follow-up periods (1.7–3 years) in two adolescent cohort studies (Dominguez et al., 2011; Escher et al., 2002). PLEs were incident in under 5% of the sample over the two year follow-up, consistent with the 3% incidence reported over 20 months follow-up in adolescents aged 13–15 years (De Loore et al., 2011), and also to the median 3% incidence of PLEs reported over one year in adult populations (Hanssen et al., 2005; van Os et al., 2009). Overall, our findings add to a small but growing evidence base (Bartels-Velthuis et al.,

Table 1
Association of child-reported PLE trajectories with internalising psychopathology at follow-up (FU).

	Unadjusted model:			Adjusted models:								
				+ sex, FU age, FU duration			+ sex, FU age, FU duration + BL externalising			+ sex, FU age, FU duration + BL externalising + BL internalising		
PLE trajectory comparisons[a]:	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
PLE remitting vs. no PLE	1.69	1.03–2.77	0.04	1.69	1.02–2.79	0.04	1.38	0.82–2.34	0.23	1.27	0.71–2.25	0.4
PLE persistent vs. no PLE	3.10	1.85–5.20	<0.01	2.86	1.68–4.85	<0.01	2.31	1.33–4.01	<0.01	2.37	1.26–4.43	<0.01
PLE persistent vs. remitting	1.84	1.18–2.86	<0.01	1.83	1.17–2.87	<0.01	1.81	1.14–2.88	0.01	1.94	1.13–3.34	0.02

Notes: FU = follow-up; CI = confidence interval.
[a] Prevalences of FU internalising psychopathology within the PLE trajectories were: no PLE (18%); PLE remitting (27%); and PLE persistent (40%).

2011; Wigman et al., 2011b) that challenges the past assumption that mid-adolescence represents the point of peak PLE prevalence (van Os et al., 2009). Rather, the expression of subclinical psychotic symptoms may peak in mid-childhood with a decreasing course through adolescence, perturbed by a lesser symptom peak in late-adolescence as the risk for onset of psychotic disorders increases (Kelleher et al., 2012a).

4.2. PLE trajectory outcomes

In line with our hypotheses, children with persisting PLEs experienced a significantly greater risk (two-fold increase) for later internalising and externalising psychopathology relative to children who presented no PLEs, as well as to children with remitting PLEs. This relationship remained significant even after adjusting for robust predictors of later psychopathology outcomes including earlier psychopathology. In contrast, children whose PLEs remitted had no greater increase in risk for psychopathology at follow-up relative to children who never presented PLEs.

Our findings are consistent with the significantly higher rates of internalising problem outcomes reported in paediatric samples with persisting PLEs (Bartels-Velthuis et al., 2011; De Loore et al., 2011; Wigman et al., 2011b). One previous longitudinal study (measuring only auditory vocal hallucination symptoms) examined the relationship between persisting PLEs and later externalising symptoms (Bartels-Velthuis et al., 2011), with no significant association observed. In our study, children reporting a range of persisting PLEs showed similar prevalence rates of internalising and of externalising psychopathology at follow-up (41% and 42% respectively); almost twice the rate of psychopathology presented by children on the No PLE and PLE remitting trajectories. Thus, persisting PLEs may impact on both psychopathology domains in equal measure. The results further indicate that the association between persisting PLEs and internalising/externalising psychopathology is not restricted to the adolescent age range, but can be extended back to children as young as 9 years.

4.3. Possible mechanisms linking persisting PLEs with internalising and externalising psychopathology

Our results imply that several cognitive models that link adult psychotic symptoms to psychopathology might be similarly applicable to children. For example, cognitive models propose that positive psychotic symptoms may act bi-directionally with emotional difficulties to increase or perpetuate both psychotic and emotional symptoms (Freeman and Garety, 2003; Myin-Germeys and van Os, 2007). Therefore, if a child with PLEs endures an event which triggers worry or self-blaming, their delusional and/or hallucinatory phenomena may become more derogatory or negative (Smith et al., 2006). This may lead to poorer coping strategies (i.e., more worry, self-blame), worsening internalising symptoms, increased attention paid towards the self-diminishing psychotic symptoms, and finally, to persistence of the child's internalising symptoms and PLEs (Lin et al., 2011).

Similarly, adult cognitive models linking psychotic symptoms with antisocial behaviour may elucidate the relationships we observed between persisting PLEs and childhood externalising symptoms. Cross-sectional reports from adult samples show threat/control-override (TCO) PLEs are associated with significantly higher levels of externalising psychopathology (Fanning et al., 2011). TCO symptoms include beliefs that others are out to harm you, that forces beyond your control affect your actions, or that your thoughts are not your own. In addition, adults with TCO symptoms show a greater disposition to misattribute hostility in others and find neutral events threatening (Fornells-Ambrojo et al., 2008; Freeman et al., 2008). As suggested in adult cognitive models linking TCO PLEs with externalising symptoms (Link et al., 1998; Mojtabai, 2006), we hypothesise that 'threat' PLEs might increase a child's risk of misattribution bias, whilst 'control-override' PLEs may reduce their ability to inhibit a restless, aggressive, or defiant response, consequently increasing the risk of externalising psychopathology (Crick and Dodge, 1994; Muris et al., 2007a,b).

Alongside alternative cognitive pathways, our findings provide some support to Tarbox and Pogue-Geile (2008) that childhood externalising

Table 2
Association of child-reported PLE trajectories with externalising psychopathology at follow-up (FU).

	Unadjusted model:			Adjusted models:								
				+ sex, FU age, FU duration			+ sex, FU age, FU duration + BL internalising			+ sex, FU age, FU duration + BL internalising + BL externalising		
PLE trajectory comparisons[a]:	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
PLE remitting vs. no PLE	1.34	0.85–2.13	0.2	1.20	0.74–1.95	0.5	1.13	0.69–1.85	0.6	0.78	0.45–1.36	0.4
PLE persistent vs. no PLE	2.43	1.49–3.95	<0.01	2.40	1.42–4.06	<0.01	2.29	1.35–3.88	<0.01	1.74	0.96–3.12	0.07
PLE persistent vs. remitting	1.81	1.17–2.80	<0.01	1.92	1.22–3.02	<0.01	1.87	1.18–2.97	<0.01	1.97	1.19–3.26	<0.01

Notes: FU = follow-up; CI = confidence interval.
[a] Prevalences of FU externalising psychopathology within the PLE trajectories were: no PLE (23%); PLE remitting (28%); and PLE persistent (42%).

and internalising pathways may follow alternate biological paths, as mediated by distinct HPA axis dysfunctions. In our cohort, which was sampled predominately from socially-disadvantaged, inner-city communities, the observed association between persisting PLEs and externalising psychopathology contrasts with a lack of similar association indicated between auditory hallucinations and externalising psychopathology in a more socially advantaged, predominantly rural cohort (Bartels-Velthuis et al., 2011). As social disadvantage in mid-childhood confers a greater risk of HPA axis dysregulation (Chen et al., 2010) and high rates of perceived threat or family chaos (Aneshensel and Sucoff, 1996), we speculate that our cohort might be more disposed to developing along a 'TCO PLE-externalising' pathway. From the results presented, we cannot draw firm conclusions about separate PLE-externalising and PLE-internalising developmental trajectories. However, the validated PLE measure used in the current study provides one item that relates to threat experiences: "Have you ever thought that you were being followed or spied upon?"; and two items related to control-override experiences: "Have you ever felt that you were under the control of some special power?"; "Have you ever felt as though your body had been changed in some way that you could not understand?". We suggest that further epidemiological research using similar PLE measures could be used to explore whether persistent PLE-externalising and persistent PLE-internalising pathways have distinct childhood HPA axis function and cognitive correlates.

4.4. Strengths and limitations

The current study has several strengths. We used a validated self-report questionnaire developed for completion by children aged from 9 years (Laurens et al., 2007, 2011, 2012) to compare the course and outcomes for persisting, remitting PLE, and no PLE trajectories, and we adjusted for key confounds including age (van Os et al., 2009), sex (Cyhlarova and Claridge, 2005), duration of follow-up, and past internalising and externalising symptoms (Polanczyk et al., 2010). Because of these strengths, we were better able to isolate the independent effect of PLE trajectory on later internalising and externalising psychopathology. Nevertheless, the present results should be interpreted in the context of several methodological limitations. We used a categorical measure of PLEs (at least one certain PLE vs. no certain PLEs) to examine associations with internalising and externalising psychopathology. Whilst all nine items from the PLE questionnaire load on a single latent construct (Laurens et al., 2012), the items do not each measure the construct equally well. We may have combined relatively benign PLEs with pathological PLEs [i.e. PLEs with pronounced relationships with psychopathology (Yung et al., 2009; Armando et al., 2010)]; however, this would have rendered the association between persisting PLEs and psychopathology harder to detect. Another potential limitation derives from our use of a categorical definition of externalising and internalising psychopathology outcomes which, despite being a clinically validated threshold, may have incurred a loss of measurement precision and misclassification of children whose subscale scores placed them in the 'borderline' SDQ range (approximating the top 11–20% of the population) of the internalising and externalising categories. This error would act to underestimate the effect of persistent PLEs by biassing associations toward the null value; nevertheless, robust associations between persistent PLEs and psychopathology in the abnormal range were detected. The study was further limited by a shorter average period of follow up (~2 years) than other longitudinal studies of similarly aged children (Bartels-Velthuis et al., 2011; Wigman et al., 2011b), possibly reducing the time for persisting PLEs to impact on internalising and externalising psychopathology and thus contributing to underestimation of the effect. Finally, the extended nature of the sampling at BL contributed to a variable follow-up period ranging from several months up to six years, which may have contributed error in our analyses; accordingly, we adjusted for the duration between BL and FU assessments in our analyses.

4.5. Implications

The findings suggest that persisting PLEs in children as young as 9 years of age may contribute to the development of later internalising and externalising psychopathology. In contrast, transient PLEs limited to mid-childhood may be benign, conferring no increase in risk for later psychopathology. This provides a cautionary note for researchers looking to move from screening to devising and trialling interventions that target PLEs reported by children aged 9–11 years. Screening for auditory and delusional phenomena in clinic referred children may be helpful, as these experiences may contribute to their presenting internalising and externalising psychopathology (Polanczyk et al., 2010; Bartels-Velthuis et al., 2011). However, cross-sectional community screening in this age group elicits a high prevalence of PLEs that are likely to remit over time. This study suggests that prolonged screening may be necessary in order to identify children presenting persisting PLEs, as this subgroup carries an elevated risk of later psychopathology.

Persisting PLEs, internalising psychopathology, and externalising psychopathology all constitute mid-childhood risk indicators for adulthood psychopathology. Persisting PLEs might constitute a novel target for reducing proximal internalising and externalising psychopathology; therefore, further study into how these factors interact may provide important insights into the aetiology and prevention of severe mental illness (Poulton et al., 2000; Dhossche et al., 2002).

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Conception of Study — JD and KRL,
Data collection — JD, MB and KRL,
Interpretation of results and manuscript drafting — JD, AEC and KRL.
Review of manuscript — JD, MB, AEC and KRL.

Conflict of interest

All authors declare that they have no conflict of interest.

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